TAGHeuer

PROFESSIONAL TIMING

Matrix Display
HL 970

User's Manual

Version 10/2008

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1. System Overview

Timing HL970 is a modular system for the management of LED displays.

The system has the capability to visualize both alphanumeric and graphic pages.
The basic of the system is a LED panel with a resolution of 96 x 16 pixels.

Panels may be placed side by side both horizontally and vertically to create a higher resolution display.
The maximum number of panels managed from the system is 16.

The system may directly interface with Tag Heuer timing software. Communication is made by serial link in both RS232 and RS485 standards.

For safety purposes the panels have low voltage control supply, in the range 10~30 VDC. The Power supply section is built into the Control Box units.

Software "**Easy Display**" is furnished to assist with the system management.
Easy Display enables system configuration, diagnostics, and management of graphics abilities.

HL970 system can operate managed either from a host PC – Slave mode - or as a master unit executing programs in its own internal memory – Master mode

Main features of the System:

- LED Panel Unit with 96x16 pixel (LED) resolution
- Up to 16 panels
- Refresh Rate in both Timing and graphic mode: 100 msec (10 Hz)
- Direct interface to Tag Heuer Timing software
- Video Programs composed of:
  - Alphanumeric pages with date & time fields
  - Graphic pages - bmp monochrome format
  - Master or Slave mode
  - Internal Flash Memory: 1 Mbytes
  - Internal Rtc (Watch) with 5 ppm quartz
  - Operating Temperature: –20..+50 °C
  - Main Power : AC voltage 85..264 VAC - 47..63 Hz or DC voltage in range 10..30 VDC
  - Diagnostics
  - Pixel (LED) error (open or short)
  - Temperature measurement of Panel and Control Box units
  - Temperature protection
  - All units are firmware upgradable

2. System Composition

2.1. Display HL970 Unit

The unit is composed of:
- 6 x DMP165 LED module (16x16 pixel resolution)
- Control Unit THCPU
- Fan 120 mm 12VDC

In Alphanumeric mode there are 4 lines of 8 characters or 1 line of 8 characters with double height and width.

External connection is made by a 4 pin IP68 circular connector.

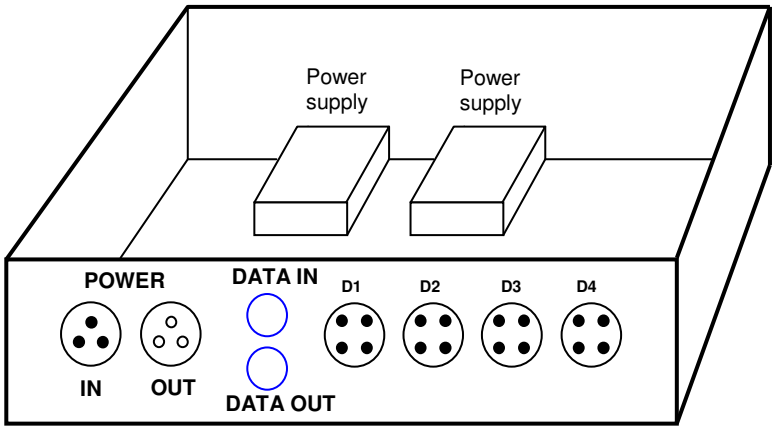
Standard supply voltage is 24 VDC, it is also possible to use a voltage supply in the 10..30 VDC range.

Main features:
- Resolution : 96 x 16 pixel.
- Input Power : limited to 75 W
- LEDs : Red 624 nm - 110/40° - 1520..2130 mcd
- Operating Temperature : –20..+ 50 °C
- Communication : 2 wires RS232 or RS485 serial link
- Dimensions : 1585 x 265 x 85 mm
- Weight : 11 Kg

Other features:
- LED Open / Short detection
- Digital temperature sensor on every LED module
- Supply voltage measurement
- Input Filter with protection for inverse polarity

2.2. Control Box

There are 2 versions
Control Box HL 970-2: with 1 power supply 24VDC and 2 panel lines connectors.
Control Box HL 970-4: with 2 power supplies 24VDC and 4 panel lines connectors.



Control Box composition:

- 1 or 2 power supplies 24 VDC 150 W
- The Power module:
  - Main power input IP68 3 pin male connector
  - Ctrl Line input IP68 8 pin female connector
  - Ctrl Line output IP68 8 pin female connector
  - Slave power output IP68 3 pin female connector
  - 2 or 4 Panel lines IP68 4 pin female connector

Main features:

- Plastic Box : 394 x 314 x 126 mm IP56.
- Main supply : 85..264 VAC 47..63 Hz (automatic)
- Max Power 2x : 150 W max
- Max Power 4x : 300 W max
- Operating Temperature : -20..+50 °C

Power Supply features:

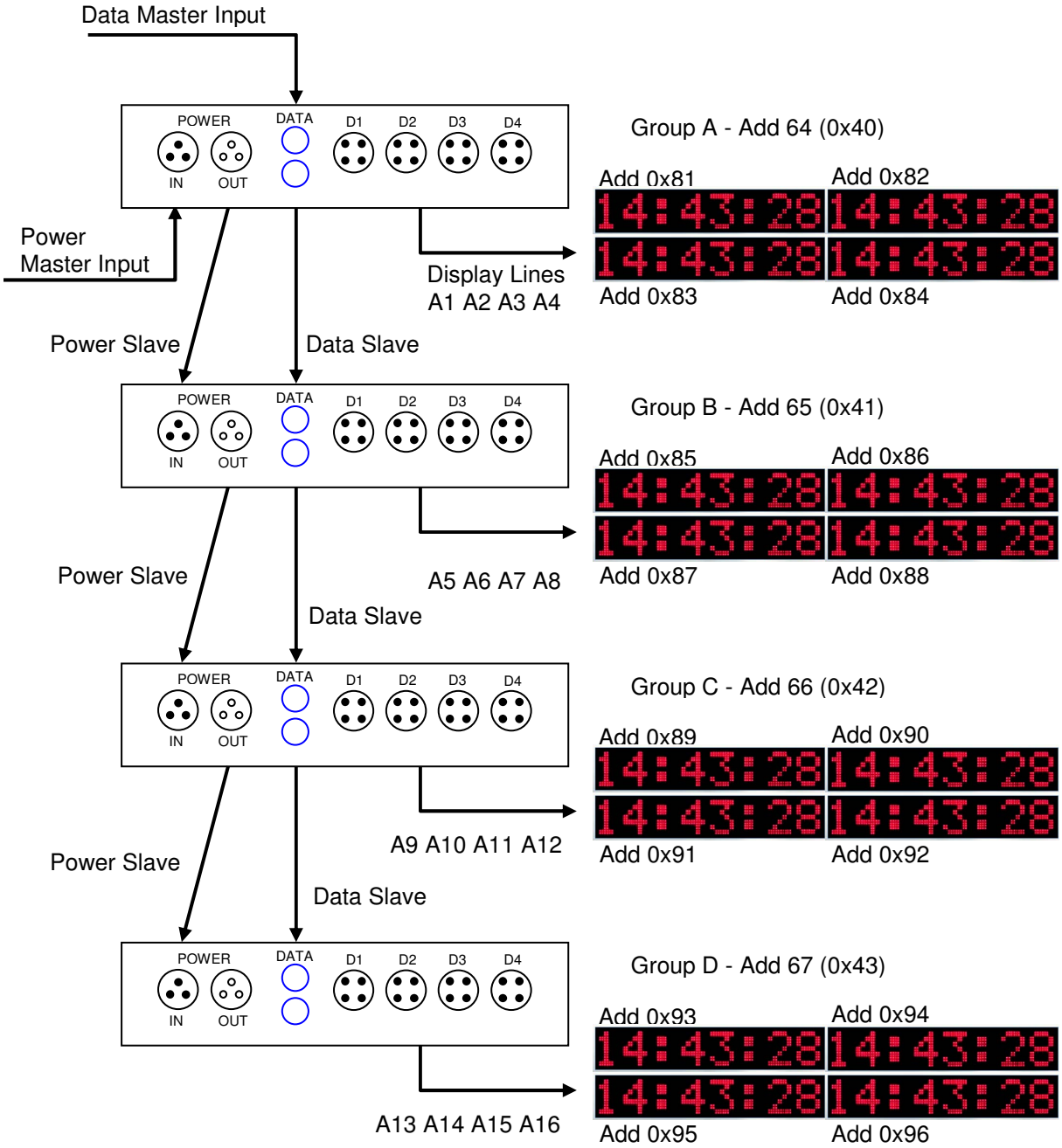
- V out : 24 VDC 150 W – 225 W peak (8 sec)
- Active PFC (Power factor correction)
- Overload / Short circuit protection (auto recovery)
- Efficiency : 87%
- Temperature : -20..+70 °C
- Derating : 2% /°C per Ta > 50 °C

Other features:

- Communication lines:
  - RS485 + RS232 input ctrl line
  - RS485 output
  - 2 (4) x RS485 display lines
- Possibility to supply the system by DC voltage source in the 10..30 VDC range
- 10 A Protection fuses for every display line
- Digital temperature sensor
- Cpu Risk 32 bit - 60 MHz
- Rtc with battery backup – 5 ppm quartz
- Flash Memory 1 MBytes

2.3. System Modularity

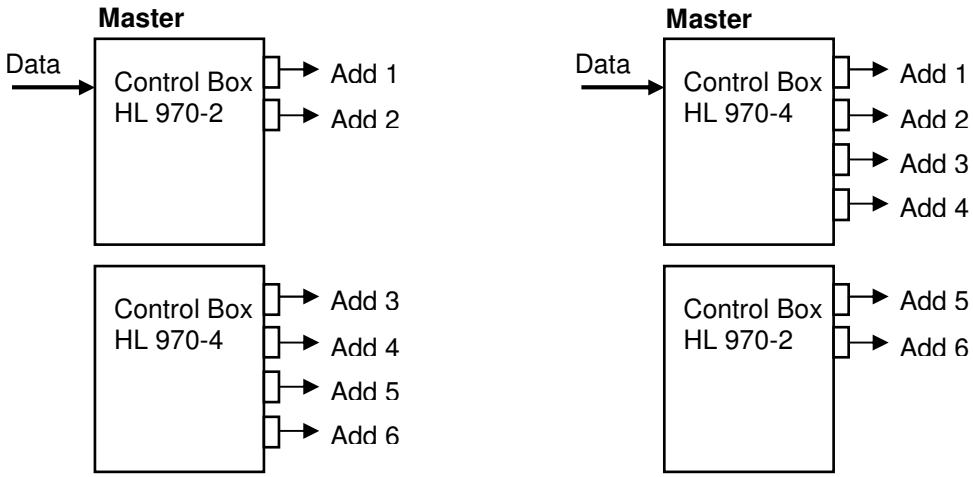
Every Control Box manages up to 4 display lines.
It is possible to connect up to 4 Control Boxes in series, for a total of 16 display lines:



The address of every unit is consistent with its position in the system.
Address sequence always starts from the master Control Box.

It is possible to have both types of Control Box in the same system. Addresses are always consecutive.

Some examples:



Panel connection is always made starting from the left top side and going left to right and top to bottom.

Examples:

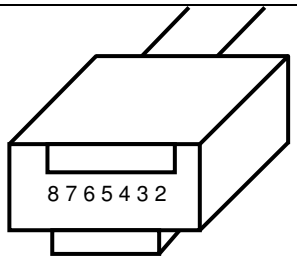
Graphic Area 288 x 48

Add 1	Add 2	Add 3
Add 4	Add 5	Add 6
Add 7	Add 8	Add 9

Graphic Area 96 x 64

Add 1
Add 2
Add 3
Add 4

2.4. Cables

Function	Connector	Pinout	Cable
Display Cable **Display cable adapter**	2x PX0748/P/04	1: 24V 2: 0V 3: 485- 4: 485+	2x1.5mmq + Twisted pair AWG24
Slave Data Cable	2x PX0410/08P/6065	1: 24V 2: 24V 3: Tx RS232 4: 485+ 5: 485- 6: Rx RS232 7: GND 8: GND	UTP Cable 8
Power	PX0731/S/03		3x 2.5mmq
	Max Current: 1200/115 = 10.5A (Main power)		
Power Slave	PX0731/S/03		3x 2.5mmq
Master Data Cable	PX410/08P/ 6065	1: 24V 2: 24V 3: Tx RS232 4: 485+ 5: 485- 6: Rx RS232 7: GND 8: GND	
	RJ45	 1. 24V 2. 24V 3. Tx RS232 4. 485+ 5. 485- 6. Rx RS232 7. NC 8. GND	
CP 540	RJ45 → Sub9D male	3 → 2 (Rx RS232) 6 → 3 (Tx RS232) 8 → 5 (GND)	

3. Easy Display

3.1. Software Structure

The software is designed to operate in Windows 2000 / NT / XP / Vista

The software consists of these main sections:

- **Setup**
  - Com Port selection
- **Configuration**
  - Display number assignment both Horizontally & Vertically
  - For every display:
    - 4 lines of 8 characters height 11 cm.
    - 1 line 8 of characters height 22cm.
  - Line definition:
    - Line number
    - Special Line with name
- **Diagnostic**
  - System Identification and Check
    - Control Box (ThPower)
    - Display (ThCpu)
    - Dmp
  - Firmware upgrade ThPower/ThCpu/Dmp
  - Visual test of displays address
  - Visual LED Test for rows and columns
  - Test LED (open and short detection)
  - Read Temperature
- **Text**
  - Text editor for advertising or information
- **Image**
  - Image editor for advertising
- **Programs**
  - Programs editor for advertising
- **System Check**
  - Check configuration (hardware and software) of the system and update the CPU of the Control Box, Display and LED

Important

On the top-left of the software's screen, you can change the brightness of the displays.

This button allows you to clear all the displays.

4. Setup

Enables you to select the Port number you will use to drive the Display HL 970 with your PC.

5. Configuration

5.1. Display Numbering

Select the number of displays vertically and horizontally.
The screen will mimic the configuration.

5.2. Display Height

Every Panel can operate as

X2 : 4 lines of 8 characters (total of 32 characters) – 11 cm high → Select Display Height
X1 : 1 line of 8 characters – 22 cm high → Select Display Height

The option « **ALL** » allow you to configure all the displays in a row.

5.3. Line

Show the soft address of the selected display, can be changed manually (warning see also the hard address chapter 2.3).

The modification of the Soft-Address may be done with the menu "**Line**" or directly on the display.

- Click the left mouse button: increase the address
- Click the right mouse button: decrease the address.

When the "**Show repetition**" option is activated, it will avoid conflicts of addressing e.g 2 similar soft-addresses, the concerned address will flash to warn you.

Trick: in the "**Diagnostic**" menu – "**Line test**" will confirm the actual settings of your display(s)

Once configuration is complete, you need to "**Send**" it to the displays.

Read the current configuration of your display with the button "**Read**"

Warning

it is possible that the function "**Send**" and "**Read**" will not work if you have the function "**Reading time**" activated in the menu "**Diagnostic**"

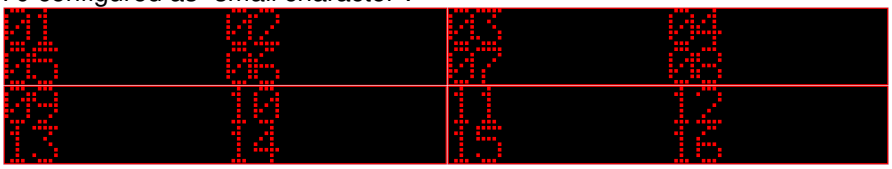
5.4. Create Lines

Create lines

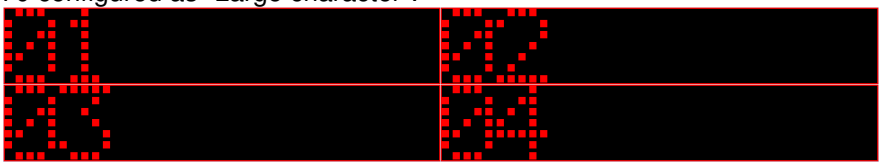
This is an automatic numbering process for the soft-addresses. Useful if you don't want to type manually all the soft-addresses of the lines.

5.5. Configuration Examples

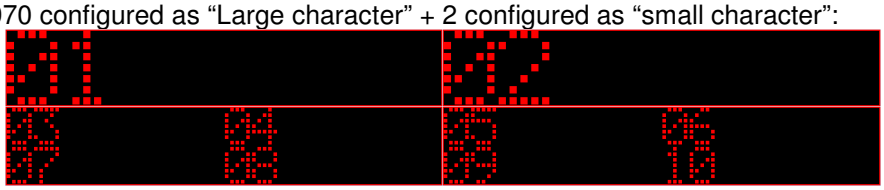
4 x HL970 configured as "small character":



4 x HL970 configured as "Large character":



2 x HL970 configured as "Large character" + 2 configured as "small character":



5.6. CP540 Setup

CP540 Setup

Direct use of the CP540. Display timing information directly on the Matrix Display

Note

In the parameters / RS232 menu of the CP540, select 9000 dBx + Running Time

Time or Speed Selection

- This configuration cannot be modified by the users

TIME:

During the race

B	I	B		1	2	:	3	4	.	5	6			
F	I	R	S	T	-	L	A	S	T		N	A	M	E

End the Finish

R	k	:		R	N	K				T	I	M	E	
F	I	R	S	T	-	L	A	S	T		N	A	M	E

SPEED:

1	2	3	.	3	4		K	M	/	H			R	N	K
B	I	B		N	A	M	E								

Km/H, m/s, MPH/H fixed text to be defined

BIB : 3 characters - number of departure
Time : 8 characters (min : sec)
RNK : ranking (classification)
Surname– Name : information is loaded into Control Box memory

It is possible to have:

- 1 display / 4 lines (11cm high)
- 4 displays / 1 line (22cm high).

Protocol example of Time Mode, Start-Finish, Speed.

1. **Competitor number and time on line 0**

   <STX> L 0 **<HT>** A _ 5 2 **<HT>** _ 5 : 3 1 : 3 6 . 2 9 2 **<HT><CR><LF>**

2. **Classification and Competitor number on line 1**

   <STX> L 1 **<HT>** A _ 2 1 **<HT>** _ _ _ _ _ _ 5 2 : _ 2 1 **<HT><CR><LF>**

3. **Speed measure N° 1 on Line 2**

   <STX> L 2 **<HT>** A _ _ _ **<HT>** _ _ _ _ _ 2 9 2 . 5 9 0 **<HT><CR><LF>**

6. Diagnostics

6.1. System Time

- **Update**
  Update software and display time according to the computer's date and time.

- **Reading**
  Show the actual software's date and time. Note: date and time are not sent on the displays (see chapter 7.1 for displaying time).

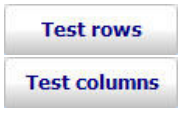
  E.g.: If you change your OS Date & Time, pressing "**Update**" will update the software and displays date & time. Then you can control the changes you've done by hitting the "reading" button (not sent on the displays, only on the software).

6.2. Address and Line

- **Address visualization**
  Display the hard-addresses of the displays. This function may be very useful if you have a large display configuration, so you can check if the cables are correctly connected.
  The hard-addresses will impact directly on the soft-addresses (see chapter 2.3)

- **Line Test**
  Display the soft-addresses of the displays

6.3. Visual LED test



Test every rows one-by-one

Test every columns one-by-one

Cadence of test may be changed in the small input box below the buttons (min 100 msec).

Entering a single number in the input box will test a single row (between 1 and 16) respectively a single row (between 1 and 96) on the display(s).

7. Text

7.1. Text

According to your configuration (soft-addresses of the displays), you can write a text and send it to the displays.
The text editor is rich of different options:

"**Open**" a text file (*.txt format) that you can import on the virtual displays

"**Save**" the text currently on the displays (as a *.txt format).

"**Cancel**", this button will clear all your virtual displays

"**Time**", display time of the software (see 6.1 for further information)

"**Date**", display the actual time of the software (see 6.1 for further information)

The "**Send**" button will display the text you see on the virtual displays.
The "**Send on changing text**" option allows you to make live modification on the display (works with Time and Date application as well).

> **Warning**
> its a "What you see is what you get" way of processing, nevertheless some characters like: â, é ü, $, ä, even if you see them correctly on the virtual displays, are not supported and not shown correctly on the displays (see chapter 11.4).

7.2. Name Files

This menu is used for the configuration "CP540 – HL970" (chapter 3.4).
It is possible to download a excel file with Bib's number and Name.

- **Save File**
  This function will read the data from the HL970 memory and export it in Excel.

- **Load File**
  This function will send the Excel file data (configured from the "**File Setup**") to the display HL970.

- **File Setup**
  This function allows you to select the excel file data with Name, Bib's number.

- **File synchronization**
  This function will synchronize the Data from excel file and HL 970.

8. Image

This menu is an image editor. It may be used to edit and create different images for advertising (logo, text etc).

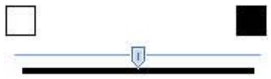
This is the tools menu of the image editor you can find on the left of the screen; it is very similar to the “Paint software” from Microsoft Windows, with some useful basic options.

You can zoom, draw, select, paint, erase, fulfill, etc.

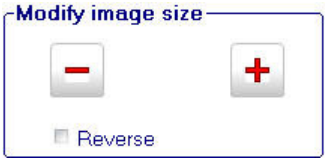
Anything you need for editing image

On the Right of the screen, you have the list of the different images currently available.
With a right-click of the mouse, further menu options are available in a drop down menu including delete.

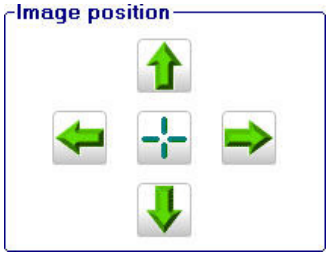
- **Import image**
  This menu allows you to import a file (Tiff, JPEG, PNG etc) with the button “open”
  You will be able to modify the image with different tools.



On the top right with this tool you can change the level of black (on the top right of the window.



Modify the size of the image. You can increase and decrease the size.
“**Reverse**” Changes the black in white and vice versa.



Change the position of the image.
The narrows move the image.
The cross in the middle adjust the image in the middle

Once you are happy with the image, use “**Insert**” to return to the menu “**Import image**”
From this stage, you will be to change and correct it manually.

- **New image**
  Create a new image (logo, text) that you can edit.

- **Save image**
  The image is saved to your hard-disk, in the same directory you have the software Easy Display.
  The software will create automatically sub-directories with the configuration of your display (ex: images_96_16 for a single display).
  Those images will be available for the “Program” of advertising (see chapter 9).

- **Send**
  Send the image from the Image editor to the displays.

- **Load**
  Allows loading an image file (Monochrome Format only) and send it directly to the displays. O

Important: The use of an image not in accordance with the system configuration is not supported.

9. Programs

This menu allows you to edit a program of advertising.

This is the main action bar from the Program menu, it will allow you to create, and edit your programs.

First, you need to open a new "**Program**". It is possible to have several programs recorded.
Only one program will show at one time (it is highlighted in blue). E.G.:

Programs	File	Time (Sec.)
Program_1	Info 1.txt	3
Program_2	Info 2.txt	3
Program_3	Inverse.bmp	3
Program_4	Text 1.txt	3

You can see that the "**Program_2**" is highlighted in blue, so it's the one active, on the "File" column we have the composition of our program. In this case, we have two text files and an image. Each files is shown 3 seconds, and then the next file is displayed.

Programs are saved to your hard-disk at the same location of the images (depends on your display's configuration).

The second step is to insert an image or text (prepared with Easy Display, from the menu "Text" or "Image"). It is possible to change the length of time the information is displayed (change by double clicking on the time column. By default 3 sec).

It is possible to change the order of the image with the green narrow (up/down).

All information shown on the display is also mimicked the screen.

The control panel appears when a program is created. You can control your program with this panel. Hitting play, forward, backward will send orders to the display.

When the Program is running, you can easily "**Stop**" it, by hitting this button.

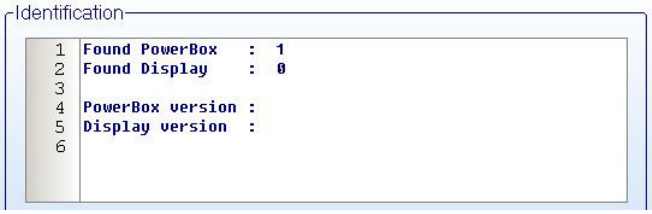
Important:
The program will change automatically regardless of your configuration (see Chapter 5)

10. Update System

This function allows you to check and update the software and the CPU of the system.
There are 3 kinds of CPU's, bye the way updates must be done for every kind of CPU's.
We have:

- 1 CPU per Control Box (Control Box CPU)
- 1 CPU per display (Display CPU)
- 1 CPU per LED board (LED board CPU)

10.1. Identify



Here is a sample of the screen you should see after pressing "**Identify**" it will identify all the devices in your system.

10.2. Identify

Identify the system (version and number of devices).

10.3. Check System

Check current version of devices in the system

10.4. Update Power

Update the Control Box CPU

10.5. Update Display

Update the Display CPU

10.6. Update LED

Update the LED board CPU

Important:
You must "**Identify**" the system before updating. After pressing "**Identify**" you will have the update options appearing below.

11. Characteristic

11.1. LED panel

LED Panels wired together will form a higher resolution display.

Input data are in bmp monochrome or in ALF (structured alphanumeric) format.

- Max page size = 32*6*9 = 1728 bytes.
- Tframe < = **100 msec**

Graphic functionality is available in both Master and Slave mode.

11.2. Protections

Every protection is calculated and acts separately.

- Frame Power: is calculated frame by frame for every panel and is limited to 75 W. Calculation is made by display units
- Panel Temperature: derating starts at 50°C, pwm is reduced up to 5% when T >= 70°C. Calculation is made by display unit
- Control Box Temperature: derating is of 2% for temperature > 50°C. Calculation is made by the Control Box unit

11.3. Timing

Display line refresh	100msec (10 Hz)
System refresh circle	< 100msec (10 Hz) The refresh cycle starts every 100 msec. Block Data are sent to slaves Control Box. Every Control Box executes the refresh cycle for its panel lines. Memory is used as a double buffer, the first one with data received from Ctrl Line, the second with data to be transmitted to panel lines. Every buffer has a dimension of 1728 bytes.

11.4. Timing Protocol

Format 8/N/1 – Standard Baud rate : 9600 baud

Frame structure: **STX NL**XXXXXXXX **LF**

STX = Start of Text (0x02)
N = Line number 0..39 , '1'..'9', 'A' + (linea – 10)
L = brightness level ('1'..'3')
X = characters
LF = end of Frame (0x0a)

Character Set:

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890/\()':.*
-+abcdefghijklmnopqrstuvwxyz

T line = 10/9600 x 12 = 12.5 msec

Timing is the default protocol at power on.
When activated, the graphic protocol is stopped on timeout condition - 10 sec without valid messages from master unit.

11.5. CP540 Protocol

Format 8/N/1 – Standard Baud rate: 9600 baud

Available baudrate: 2400 / 9600 / 38400 / 57600 baud

Frame structure, 24 characters:
STX 'L' N TAB 'A' nnn TAB Time TAB CR LF

N°	Characters	Description	Code	Info
1	1	Command Start	02h	Start of Text
2	1	L = Line	4Ch	
3	1	Line number	0…9	Line selector
4	1	Horizontal tab	09h	
5	1	A = 'alphanumeric'	41h	
6-8	3	Competitor number	000…999	
9	1	Horizontal tab	09h	
10-21	12	Time value		Hh:Mm:Ss.DCM
22	1	Horizontal tab	09h	
23	1	Carriage Return	0Dh	
24	1	Line Feed	0Ah	

11.6. Standard Protocol

This protocol is used on Master Data line, Slave Data Line and Display line.

Format 8 / N / 1 - Standard Baud rate = 115'200 baud

- **Standard Request Format:**

  <EOT> <EOT> <ADD> <STX> CODE [ASCII_DATA] **<ETX> <LRC>**

- **Standard Answer Format:**

  <EOT> <EOT> <ADD> <STX> 'D' CODE [ASCII_DATA] **<ETX> <LRC>**

<EOT> : 0x4
<STX> : 0x2
<ADD> : address 0..255 – 0 = general address
<LRC> : check sum of all bytes in command string from STX to ETX
ASCII_DATA : binary data must be transmitted in 2 characters (ex. 0xF8 => 'F8')

Answer Characters:

<ACK> <ACK>	0x6 0x6	= Command successfully executed
<NAP> <NAP>	0x9 0x9	= Command parameter not valid
<NACK> <NACK>	0x15 0x15	= Command unknown

TAGHeuer

PROFESSIONAL TIMING

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